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The Naming of Objects and Symbols by Children and Aphasic Patients

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Three studies of naming in children and in aphasic patients were conducted in order to determine the kinds of errors made in the naming of objects, parts of objects, and various kinds of symbols, and to evaluate the contribution of operativity to the ease of naming such elements. Operativity refers to the extent to which elements can be transformed and involved in a variety of sensory and motor schemes. It was found that operativity of depicted elements makes a significant contribution to ease of naming for both groups of subjects. However, children and aphasic patients made different types of naming errors. In the case of naming of symbols, the categories easiest for aphasics to name proved the most difficult for children to name. It is suggested that the partial loss of an acquired ability can produce a different clinical picture than the partial acquisition of that ability in the normal child. The concept of operativity may be a less useful concept in the relatively figurative domain of symbols.

INTRODUCTION

Attaching the appropriate name to a perceived object or symbol is a deceptively simple act. Normal adults perform this activity with such effortlessness that only rarely does the process enter conscious awareness. On analysis,

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however, the task proves far from elementary. The individual must isolate the "target configuration" from numerous other percepts, focus on its identifying portions, then access the appropriate linguistic form from a large number of alternatives. A further complication arises when the individual is required to name a drawn configuration outside its customary context merely to satisfy an experimenter's request. It is not surprising that it takes several years before children are able to name with precision a range of objects and symbols (Brown, 1958; Stern, 1930) and that this capacity is fragile under conditions of brain·damage in the dominant hemisphere (Geschwind, 1967). Because the ability to name is (in one or another sense) incomplete in these populations, their existence offers an opportunity to examine the development and breakdown of naming capacity and perhaps to clarify the fundamental nature of naming.

Two factors are commonly acknowledged to contribute significantly to ease of naming. Nearly every study has demonstrated that those objects which are familiar and whose names are frequently employed in the language are more likely to be produced appropriately than those of lesser familiarity and frequency (Oldfield, 1966; Rochford and Williams, 1965). Similarly, it has widely been noted that children find it easier to name objects, or representations of objects, than to name so-called arbitrary symbols, such as letters or numbers (Gibson, 1969). Though this probably reflects, in part, the greater frequency of and importance attached to objects, it is also plausible that entities which "really exist" in the world are more meaningful and salient for children than those which do not exist as physical objects in the world, and that depictions of real objects are more readily accepted by children than depictions of entities which do not exist in the world of visible objects. On this argument, letters would be more difficult to name even if parents attended to them while neglecting dogs, tables, and bottles of milk.

Whatever the relative difficulty of naming objects and symbols, there remains the question of which *particular* objects and symbols are more readily named. Observations of naming by children and aphasic patients, and theoretical considerations following from the cognitive theories of Piaget (Piaget and Inhelder, 1968; Gardner, 1973*a*, Chapter 3), have suggested that in addition to the factors cited an important element in the ease of naming is the *operativity* of the element being named. Following Piaget, an element is considered relatively *operative* to the extent that it is discrete and separable from its surrounds, lending itself to manipulation and transformation by an individual; operative elements arouse a variety of actions and appeal to a number of sensory modalities. In contrast, an element is considered relatively *figurative* to the extent that it blends into its surrounding context, is difficult to grasp, and is known primarily through the visual modality. On these definitions, objects and parts of objects are more operative than numbers, letters, or such quasisymbolic elements as colors, since the latter items are less prone to engage multiple sensory channels or arouse varied actions. Yet, within the domains of objects and symbols, analogous distinctions can be made. Objects and parts of objects can be divided into those which are relatively operative (e.g., book, screwdriver, finger) and those which are relatively figurative (e.g., wall, cloud, hip). Similarly, symbolic elements may also vary in the event to which they arouse operative "schemes." Letters are relatively pure visual configurations, to which a name is attached; on the other hand, numbers have the potential to arouse tactile-somesthetic modalities, and such actions as adding, coordinating, and multiplying (Piaget, 1965; Geschwind, 1962). Thus, within the realm of symbols, numbers appear to be more operative than letters (or colors).

The purpose of the present series of studies is to compare aphasic subjects and children on the naming of objects and symbols, to specify the number and kinds of errors, and to evaluate the contribution of operativity to performance on the tasks. Since the paradigms and patients used here have been reported elsewhere (Gardner, 1973*b*,*c*), they will be summarized briefly.

STUDY 1. THE NAMING OF DEPICTED OBJECTS AND OBJECT PARTS

Methods

Subjects

The subjects were 22 aphasic patients with focal brain lesions, hospitalized in the Aphasia Research Unit of the Boston Veterans Administration Hospital; 11 patients admitted to the hospital for nonneurological purposes; 40 preschool children ranging in age from 3,0 to 4,11, attending daycare centers in the Boston area. Aphasic subjects were blocked in terms of lesion site: 11 patients had focal lesions located exclusively in the anterior (frontal lobe) area of the dominant hemisphere, and the remaining 11 had focal lesions exclusively in the posterior (temporal and parietal) area of the dominant hemisphere. Localization was based on brain scans (in nearly all cases), surgeons' reports, EEGs, field defects, and clinical observations. The 11 control patients included in the study were hospitalized for nonneurological reasons. The patients were all right-handed males at the Boston Veterans Administration Hospital; the groups were matched approximately in median age (53), socioeconomic background (working class), and educational level (high school).

The children were drawn primarily from working-class families and were blocked in terms of age (3-year-olds and 4-year-olds) and sex. With the exceptions noted below, the group differences within the adult and child populations were not significant and will not be analyzed in this report.

Materials

Stimuli were four different pictures representing a city street, a scene in the country, the interior of a house, and the body of a woman (with the close-up of a head on a separate sheet). Each picture was drawn in black ink on an 8½- by 13-inch piece of white cardboard. Each picture contained many objects, parts of objects, and other elements ordinarily found in that setting. A composite picture, rather than a drawing of each element, was used for two reasons. First, it was possible to depict elements (such as body parts) which are difficult to portray in isolation. Second, it was thought that including elements in their natural environment would reduce the abstractness of the task (Goldstein, 1948), hence making it a "purer" naming task.

A list of elements in each picture was drawn up and shown with the pictures to four psychologically trained judges. By a judging procedure detailed elsewhere (Gardner, 1973*b*), 18 elements were selected for naming in each picture: three operative and three figurative elements at each of the three levels of frequency, matched insofar as possible in length and pronounceability.

Procedure

A subject was shown one of the pictures and told to name elements designated by the experimenter. The element was designated with a hand pointer for approximately 1 sec; if the item was small, the pointer remained on it; if the item was larger, the pointer passed quickly over the relevant portions of the picture. The subject was then asked to name the item; if he had not answered correctly after 30 sec, he was given four choices: the correct name, a word which might be semantically confused with the target, a word which might be acoustically confused with the target, and a word with no obvious associations to the target. These choices were presented orally by the examiner; the subject could either indicate the correct choice orally, or in the case of expressive difficulties point to one of four fingers which were raised serially as the four choices were given. With a few exceptions (e.g., plurals were accepted for some items), the subject had to give the precise name chosen in advance. Neither synonyms, paraphasias, nor "baby talk" were accepted. All relevant variables, such as order of presentation of the pictures, order of words within each picture, and presentation of multiple choices, were counterbalanced.

Results

Adult Controls

The 11 control subjects gave the correct answer immediately in nearly all cases; in only three of 792 items were multiple choices required. For this control group, there was no significant difference between the operative and figurative items, or between words of differing frequencies, in the number of correct answers, or in the average latency of response.

Aphasics

The aphasic subjects required multiple choice on 26% of the items; they made very few errors, missing only 10% of the items on which a choice was necessary. In all, there were 22 semantic, 11 acoustic, and 11 random errors. This result indicates the aphasics had little difficulty in recognizing the elements and in identifying their names, and that they differed from normal subjects primarily in the ease with which they spontaneously produced the name. Accordingly, the scores of critical interest were the number of correct answers given by subjects before the presentation of multiple choice.

A repeated-measures analysis of variance with frequency and operativity as within-subject variables and aphasic group as between-subject variable was performed on these scores. This analysis revealed that operativity ($F = 66.35$, $p < 0.01$) and frequency ($F = 50.96, p < 0.01$) made significant and comparable contributions to naming. There were no interactions and no significant differences between the groups of aphasics. Results are summarized in Fig. 1.

Children

The children had more difficulty in recognizing and correctly naming the elements. They required multiple choices on 40% of the items, and missed 49% of the items on which a choice was necessary. There were 282 semantic, 139 acoustic, and 145 random errors. A repeated-measures analysis of variance indicated that, as with the aphasics, both frequency of the words ($F = 363.36$, $p < 0.01$) and operativity ($F = 180.15, p < 0.01$) were significant factors.

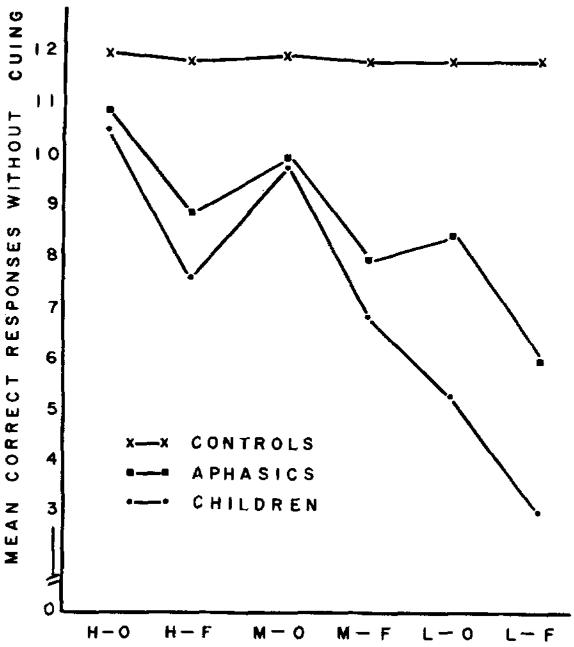

Fig. 1. Mean number of correct responses made by aphasic subjects, normal adults, and normal children on the object-naming test. The names are grouped on the basis of frequency (High, Middle, Low) and on the basis of relative operativity (Operative, Figurative).

Analysis of Errors

In order to determine the kinds of errors made by subjects, the initial errors made on each item were analyzed. A category-rating system was devised and adequate interjudge reliability (0.82) was obtained on 100 aphasic responses and 100 responses of children. Thereafter, 400 aphasic and 400 children's initial errors were categorized by the author according to this system. Through use of an unbiased system of error selection,[2] every subject

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[2] Errors were selected for inclusion in the analysis as follows: Eight places in the protocol located at even intervals from one another constituted the beginning points for selection of errors. The first error included from subject 1 was his first error after location 1, the first error from subject 2 was his first error after location 2, and so on until the ninth subject, whose first error came from location 1. One error was taken from each subject until all subjects' protocols had been passed through. Then the next error on a succeeding item in the protocol of subject 1 was included and, again, all remaining protocols were passed through, so that an additional error would be procured from each subject. This procedure was repeated until a total of 400 errors had been procured from

Table I. Types of Errors Made by Children and Aphasics on Object-Naming Test

Response	Subject group	
	Children (%)	Aphasics (%)
Synonyms/metonyms[a]	36	32
Don't know/forget	18	0.5
Contiguous item named	6	4.5
Same semantic cagetory/semantic paraphasia	6	18
Element described	14	8
Visual confusion[b]	6	2
Irrelevant response	1	11
Literal paraphasia	0.5	13
Perseverative response[c]	1	7
Baby Talk	4	1
Other/nonclassifiable	7.5	3

[a] Response was an alternative name for the designated item, a part of the item instead of the whole item, or a larger item in which the designated item was included.
[b] Response was the name of an item with a physical resemblance to the designated item.
[c] Response was a repetition of response given for one of four preceding items.

was represented with some errors, and no subject's performance dominated the analysis. Results of this analysis are summarized in Table I. It can be seen that the error profiles of the aphasic subjects differ markedly from those of the children. The children have a much larger proportion of "don't know" responses, consistent with their lower scores on recognition of correct names; they also show a greater tendency toward visual misidentifications, (e.g., confusing *banana* with *boat*), describing the element in lieu of its name (characterizing a *broom* as "something you sweep with"), and using baby talk (e.g., "tummy" for *stomach*). The aphasic subjects are more likely than the children to respond with a member of the same semantic category (a semantic paraphasia), to produce approximations to the principal sounds of the target word but in the wrong order (literal paraphasia), to perseverate on a previous response, or to give a nonsensical or totally irrelevant response. Each group has a large number of responses which are either synonymous with the target but not the required lexical item (e.g., calling a *path* a *walk*) or are metonymic (part for the whole, whole for the part). Anterior aphasics, whose comprehension deficit is less severe, are more likely to give these synonymous or metonymic responses (Gardner, 1973*b*).

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each subject group. Because some subjects made only a few errors, their protocols were discarded after all their errors had been included. Only a representative portion of the errors of the least proficient subjects was included in the 400 final items.

STUDY 2. THE NAMING OF SYMBOLS

Methods

Subjects

The subjects were 40 right-handed male aphasics at the Boston Veterans Administration Hospital. Fifteen had focal lesions restricted to the anterior (frontal lobe) region of the dominant hemisphere; 15 had focal lesions restricted to the posterior (temporal-parietal) regions of the dominant hemisphere; ten were global aphasics with damage extending from the anterior to the posterior regions of the dominant hemisphere. Lesions were localized according to brain scans (available in nearly all cases), EEG records, surgeons' reports, field defects, and clinical findings. Also included were ten normal control subjects who were patients on the nonneurological wards of the hospital.

The 40 children who participated in the study were 3- and 4-year-olds selected from daycare centers in the Boston area. The subjects were drawn primarily from working-class families and consisted of approximately equal numbers of 3- and 4-year-olds, males and females. These group differences were not significant and are not reviewed in this report. Most of the children and aphasic subjects had also participated in Study 1, with at least a week intervening between the two sessions.

Materials

The stimuli were 24 index cards (5 by 8 inches) on each of which one symbolic element was depicted in black ink or crayon. The term *symbol* was construed broadly to include any element which denotes or exemplifies an object, property, or concept (*cf.* Goodman, 1968; Gardner *et al.*, 1974). Accordingly, specimens of colors and drawings of animals can be considered symbols, though the interpretation of the results does not depend on an acceptance of this formulation. If an alternative interpretation is preferred, the drawings of animals can be considered a baseline measure against which the other "more symbolic" categories are judged.

The cards fell into four categories, each being represented by five common elements and one somewhat less common element. The elements were as follows, with the less common element listed last: *colors*: yellow, orange, red, blue, green, grey; *numbers*: 9, 7, 6, 4, 2, 13; *letters*: R, A, S, M, E, V; *animals*: dog, cow, monkey, horse, cat, rhinoceros.

Procedure

Subjects were shown the cards one at a time and asked to name the element depicted. If, after 15 sec, they had not named it, they were given a cue: the name of the category to which the element belonged. In the case of aphasic patients, a multiple choice was given after 30 sec; in the case of the children, there was no multiple choice and the experimenter proceeded to the next item. The results on multiple choice with aphasics have been presented elsewhere (Gardner, 1974) and will not be reviewed here.

Results

Normal Subjects

With the exception of two subjects, who required multiple choices on the color *grey*, all control subjects answered immediately and correctly in the allotted period.

Aphasics

For the most part, aphasics experienced little difficulty in naming the elements in the allotted period. Multiple choices were needed on approximately 1.5 items per category. A major exception were the global aphasics, who have considerable difficulty in all aspects of language (Goodglass and Kaplan, 1972).

A summary of the categories on which subjects answered correctly without multiple choices is given in Fig. 2. It can be seen that aphasics had equivalent difficulty in naming the colors and tha animals, found letters somewhat easier, and numbers by far the easiest category to name. A repeated-measures analysis of variance with category of symbol as the within-subject variable indicated a significant difference across categories ($F = 13.03$, $p < 0.01$). A Newman-Keuls *post hoc* comparison between all pairs of means revealed that numbers were significantly easier to name than each of the other categories; there were no significant differences among the three other categories.

Children

As Fig. 2 indicates, the profile of the children was essentially opposite to that of the aphasic patients. For this group, colors and animals were by far

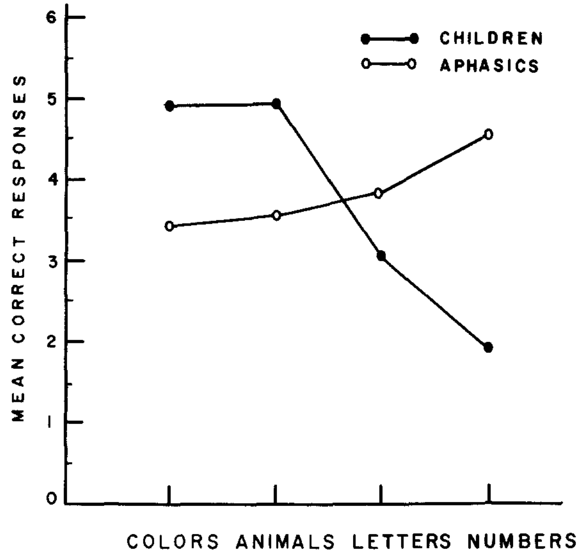

Fig. 2. Mean number of correct responses made by aphasic subjects and by children on each category of the symbol-naming test.

the easiest elements to name, letters were of intermediate difficulty, and numbers were the most difficult. Indeed, there is a double dissociation between children's and aphasics' profiles on this test; only one child performed better on letters and numbers than on animals and colors, while only six aphasics performed better on animals and colors than on letters and numbers ($X^2 = 29$, df = 1, $p < 0.01$). A repeated-measures analysis of variance revealed a significant difference across category elements ($F = 47.29$, $p < 0.01$). A Newman-Keuls comparison of means indicated that numbers were more difficult than all other categories, and that letters were more difficult than colors and animals. A significantly greater number of subjects could name correctly all of the letters than could name all of the numbers ($X^2 = 5.6$, df = 1, $p < 0.025$).

Analysis of Errors

An analysis of initial responses to each item was undertaken with results similar to the analysis undertaken in Study 1. A further analysis of initial responses was undertaken with reference to the symbolic categories to which the erroneous responses belonged. Results of this analysis appear in Table II. There was considerable difference in the error patterns of aphasics and children, as well as considerable differences in the kinds of erroneous

Table II. Types of Errors Made by Aphasics and Children on Symbol-Naming Test

Type of symbol response		Subject group	
		Aphasics (%)	Children (%)
Animals	Intracategory	25	68
	Extracategory	3	0
	Wrong	23	11
	Other[a]	49	21
Colors	Intracategory	41	60
	Extracategory	10	7
	Wrong	23	8
	Other	26	25
Letters	Intracategory	33	37
	Extracategory	16	18
	Wrong	20	13
	Other	31	32
Numbers	Intracategory	50	44
	Extracategory	9	28
	Wrong	16	6
	Others	25	22

[a] Other responses include perseverations, paraphasias, filler remarks, and any other responses which were not completely wrong.

responses given for the various categories of symbols. One trend discernible across categories was the aphasics' larger proportion of responses which were totally wrong–i.e., had no direct relation to the stimulus. In contrast, the children generally produced more responses which belonged to the same category as the correct response. The number of responses which belonged to one of the other categories (e.g., a number being called a letter or color) was relatively low for both populations in all conditions; the sole exception was the younger group, over 25% of whose responses to the numbers were instances of the other categories, primarily letters. The children made few extracategory errors in the case of animals and colors, more extracategory substitutions in the case of letters and numbers. The number of perseverations, paraphasias, and general filler comments (e.g., "Oh, I know what that is") was fairly constant across categories, with both aphasics and children making about 1/4 responses of this sort. The children produced relatively more filler responses, the aphasics more perseverative and paraphasic responses. The only exceptions to this generalization were the names given by aphasics to animals; in this case, nearly half of the errors were semantic paraphasias.

A final trend in the error data was that each subject group tended to make more within-category errors in the categories in which their performance was better, while producing more wrong answers and extracategory errors in those categories where their overall performance was deficient. Thus children made more intracategory errors on animals and colors, aphasics more on letters and numbers. Correlatively, children made more extracategory errors in letters and numbers, often confusing members of these two categories.

STUDY 3. REPLICATION OF STUDY 2

Because of the unexpected finding that children had the poorest performance on the category of numbers, an additional group of 20 subjects aged 3 and 4 was run on a modified version of Study 2. In this version, the child was again required to name the colors cited above as well as six numbers (1, 3, 5, 7, 8, 12), six letters (B, L, T, H, C, G), and six articles of clothing (shoes, dress, socks, pants, hat, tie). The purpose of this condition was to determine whether the same categorical trends could be obtained using different letters and numbers, or whether the findings were restricted to the particular ones selected in Study 2.

A repeated-measures analysis of variance revealed a significant difference in the difficulty of the categories ($F = 11.03, p < 0.01$). A Newman-Keuls *post hoc* comparison of means indicated that clothing was significantly easier to name than letters and numbers, and that colors were significantly easier to name than letters and numbers. There was no significant difference in difficulty of letters and numbers, though the trend was toward letters being slightly easier. The distribution of answers for letters and numbers differed, however. Sixteen of the subjects named all letters correctly or all incorrectly, while only eight of the subjects displayed these extreme performances with numbers ($X^2 = 5.00$, $p < 0.05$). This finding suggests that subjects tended either to know their letters completely or not at all, while they more often knew some numbers.

DISCUSSION

While the results do not reveal any simple pattern which can account for naming performance, a number of trends deserve comment. Beginning with a review of the principal findings, it has been shown that both aphasics and children show a similar profile when attempting to name objects or parts of objects. They find it easier to name spontaneously those objects which are relatively operative and those objects whose names appear more frequently in the language. The aphasic patients have little difficulty recognizing the objects which are depicted or identifying their names on multiple choice; this reflects both the circumscribed nature of their lesion and their accumulated experience in the world of objects. The items which the children were unable to name spontaneously or to recognize on multiple choice were to a large extent those whose names they did not know or those with which they were only somewhat familiar; in this case, frequency of word and object made the most significant contribution to the ease with which the object could be named.

Though the performances of aphasic patients and children were parallel on the object-naming test, a different state of affairs obtained on the symbol-naming test. Indeed, the two groups had essentially opposite performances: the aphasic patients had the greatest difficulty in naming the "least symbolic" materials–animals–nearly as great difficulties in naming colors, while letters were only moderately difficult and numbers were the easiest. The children, on the other hand, performed quite well with animals and color names, made an intermediate number of errors on letter names, and had the most difficulty naming numbers correctly. In the case of letters, children tended to know them all or not to know any of them; in contrast, most children knew some numbers but made errors on others.

Patterns were also discernible in the incorrect responses given initially to the stimuli. In the case of objects, both groups gave many synonymous or metonymic responses; these are of limited interest as they can be expected in such a task. Otherwise, children most commonly said they did not know the object's name, described the object instead of naming it, or made visual confusions. The aphasic patients rarely asserted that they did not know the name, and rarely made visual confusions; they had more misnamings on the basis of sound confusions, competing elements within a category, or totally irrelevant responses. Analyses of errors in the symbol-naming test reinforce some of these findings. Aphasic patients gave more perseverative and wholly irrelevant responses. Children gave more responses which belonged to the correct category, and were also prone to confuse numbers with other symbols, particularly letters. Each group was more likely to make within-category errors on those categories where its performance was relatively better.

What factors other than frequency and operativity can be said to aid the two subject populations in correctly naming a visual configuration? In the case of the children, it is clear that physical and "operative" elements (such as animals or clothing) are easier to name than more symbolic elements (such as letters and numbers). Colors are named with a skill associated with object naming; this may be because, while colors do not exist in isolation in the world, colors-in-context are as constant a part of experience as animals and objects. On the other hand, letters and numbers do not exist in the material world, a fact which may make them "figurative," arbitrary, and meaningless for children. It is, of course, also true that letters and numbers are less often taught to children, even in this Sesamean age; yet, even when their names are explicitly taught, their visual similarities, auditory confusability, and remoteness from daily experience may make them difficult to master.

For adult aphasics, physical elements such as animals are relatively more difficult to name than letters and numbers. Why should such apparently more abstract and less operative elements be easier to name? Perhaps there is some contribution in the relative ease of enunciating letter and number names; yet this cannot account for the entire result since the names of colors and animals used in the study were not difficult to enunciate. It is tentatively proposed that, once learned and "overlearned," the name of a number or letter becomes virtually an automatic response when these symbols are perceived; these elements are known, in the case of letters, exclusively and, in the case of numbers, largely through their names. Furthermore, they are typically seen on a piece of paper. To see and recognize these elements *is* to name them. On the other hand, the very fact that animals and colors can be perceived in a variety of contexts and are involved in assorted schemes may paradoxically make them more difficult to name correctly; there are operations and activities other than naming with which these elements are habitually if not automatically involved. Thus the names of numbers and letters stand out as "figures" to a greater extent than the names of colors and animals.

A further hypothesis concerning aphasic patients comes from the relatively rare syndrome of pure alexia without agraphia (Benson and Geschwind, 1969). This syndrome, resulting from an infarct in the left visual cortex and a disconnection of the right visual cortex from the language area via a lesion in the splenium of the corpus callosum, produces a striking clinical picture: patients can name animals and other objects with little difficulty, yet are unable to name letters, colors, or words and have moderate difficulty with numbers. One plausible explanation for this condition is that the naming of colors, letters, and words involves a relatively "pure" association between a visual configuration and a name, whereas the naming of objects arouses many nonvisual associations; accordingly, the name of objects can be aroused through pathways going from the visual area via a more circuitous route to the language area. On this interpretation, numbers are of intermediate difficulty, since they are more of a pure visual configuration than objects, yet may arouse tactile and somesthetic associations, thereby opening alternative pathways to those available for letters or words.

If the ability to name letters and, to a lesser extent, numbers can be selectively destroyed, it follows logically that there may be conditions in which the ability to name letters and words is preserved in the face of difficulty in naming of objects. Such conditions do in fact exist in pure anomias (Gardner, 1973*b*; Geschwind, 1967; see also Goodglass *et al.*, 1966). In this condition, objects are usually recognized but the associative network permitting the arousal of the appropriate name has been partially destroyed. The name may eventually be produced, but only after paraphasic variations have been enunciated. A similar situation may explain the present findings.

It can be assumed that naming of symbolic elements, learned relatively late and dependent on the association of a visual configuration with the language areas, involves relatively circumscribed cortical zones and connections. In contrast, the naming of physical objects, which occurs early and in diverse contexts, may result from the activation of much larger regions of the brain. Furthermore, isolated letters and numbers are generally named when they are recognized, whereas physical objects are involved in many nonnaming schemes. If follows that, so long as the usual circumstances of symbol naming obtain and the specific cortical areas involved are spared, symbol naming should be relatively unhampered; if these areas are destroyed in focal lesions, as in cases of alexia, all processing of these symbols will become impossible. On the other hand, as suggested, naming of objects may occur under a larger variety of circumstances, over the course of which a much larger total cortical area is involved; accordingly, some impairment of naming should occur in nearly all forms of dominant hemisphere pathology and some preservation of this capacity should be noted even under conditions of severe pathology (Geschwind, 1967). On balance, then, most aphasic patients should find it easier to produce the names of symbolic elements immediately, as these involve fewer competing schemes and a relatively circumscribed neural zone, than to name the more "operative" elements of the physical world, which are embedded in a greater variety of (naming and nonnaming) schemes, some of which are likely to be impaired in any cortical damage.

This configuration of results calls into question the widespread assumption that depicted elements can be easily divided into "symbolic elements," which are arbitrary and hence difficult to process, and "nonsymbolic elements," which are natural, concrete, and, therefore, accessible to individuals. Analysis suggests that any line drawn between symbols and nonsymbols, between arbitrary and nonarbitrary elements, is necessarily tentative (Goodman, 1968; Gardner *et al.*, 1974). Indeed, it may make more sense to consider any mark on a page as a symbol so long as that mark is designed to represent, denote, or exemplify. On this interpretation, a sketch of a dog and the written word *dog* are both symbolic, as each is a configuration of lines meant to denote the concept of dog. If this viewpoint is adopted, one may then propound a theory of naming which cuts across the gamut of materials, "symbolic" and "arbitrary" as well as "physical" and "natural."

Our results suggest that, while there are certain common patterns in the naming behavior of children and aphasic patients, the process of acquisition is by no means directly mirrored in dissolution under the conditions of brain damage. To be sure, frequency and operativity within the category of physical objects aid both subject populations. Yet naming of numbers is easiest for aphasics but difficult for children, and objects are easiest for children to name while posing difficulty for aphasics. It is proposed that different factors may facilitate the learning of names in the child and the production of names in the intact or brain-damaged adult. The child finds it easier to name those physical elements or objects with which he comes into contact and toward which he directs a variety of meaningful acts and sensory modalities than to name those elements which exist only within a symbolic system. Yet when it comes to learning members of a symbol system, it may be easier for him to learn those elements which have a distinctive visual configuration and which are not easily confused with other symbols (Gibson, 1969), either because of visual resemblance (6 and 9, B and P) or because those symbols are involved in schemes other than naming. What may make number naming somewhat more difficult for the growing child is the fact that numbers (unlike letters) are also involved in daily activities where their visual configuration is not evident, as, for example, in the telling of time, making of change, or counting of objects. This embedding in other activities initially causes confusion on the part of the child, eliciting intra- (and extra-) categorical errors in the naming of numbers. On the other hand, there are few competing responses or activities involving letters; the pure visual-language links evoked in naming letters may make these symbols somewhat easier for the child to learn initially. This situation suggests that operativity may be a mixed blessing for the child learning symbols. Alternatively, it may indicate that operativity is a less useful concept within the relatively nonoperative realm of symbols than it is in the domain of objects and part of objects.

The adult has of course learned the names of all letters and numbers, as well as the objects included in our test. When an adult brain is injured, naming may be relatively easier for those figurative elements which arouse highly overlearned automatized patterns of response. Secondarily, letters and numbers, which most frequently are named when confronted and which are parts of well-developed systems and routines, may be easier to name than disparate objects which fit into various contexts including many where they are not habitually named. Thus we have the situation where those elements which are relatively figurative and "symbolic"–letters, numbers and perhaps colors–are easier for the brain-injured individual to name than certain physical objects which are more operative. Yet, within the category of symbolic elements, those which have relative operativity–i.e., numbers–are easier to name than those which entail exclusively visual associations; similarly, those objects which are relatively operative within the realm of physical objects prove easier to name than those which are relatively figurative. The very operativity which may cause initial confusion in the learning of number names eventually makes this category of symbols easiest to name. In sum, neither operativity alone nor the absence of competing responses alone can account for naming performance, but a judicious consideration of these two factors may offer insights into the nature of the naming process.

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